USDA Natural Resources
Conservation Service

Ecological site R035XY009UT
Alkali Flat (Greasewood)

Accessed: 05/11/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

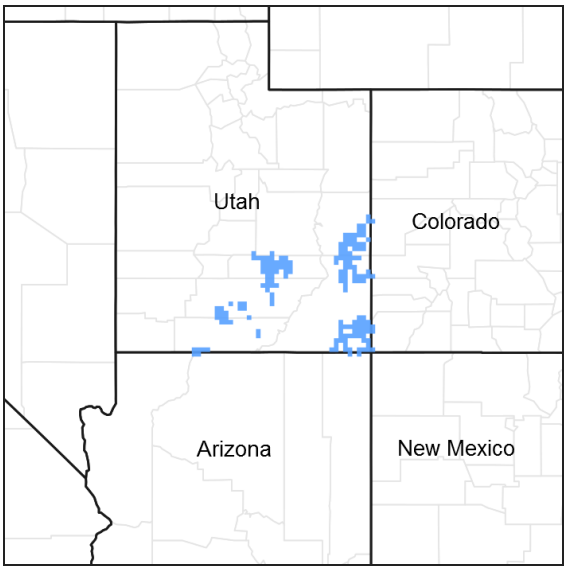


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Associated sites

R035XY006UT	**Alkali Fan (Valley Saltbush)**
R035XY011UT	**Loamy Bottom (Basin Big Sagebrush)**
R035XY012UT	**Semiwet Saline Streambank (Fremont Cottonwood)**
R035XY103UT	**Desert Clay (Castle Valley Saltbush)**
R035XY118UT	**Desert Sandy Loam (Fourwing Saltbush)**
R035XY130UT	**Desert Shallow Sandy Loam (Shadscale)**

Similar sites

R028AY004UT	**Alkali Flat (Black Greasewood)**
R034BY006UT	**Alkali Flat (Greasewood)**
R035XY003UT	**Alkali Bottom (Greasewood)**

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Sarcobatus vermiculatus*
Herbaceous	(1) *Elymus elymoides*

Physiographic features

This site occurs on alluvial valleys, alluvial fans, flood plains, valleys, stream terraces, and valley flats. Run off is low to high. Slopes range from 0-4% and elevations are generally 4300-6600 ft.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Flood plain (3) Valley
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	4,300–6,600 ft
Slope	0–4%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool to warm winters, which can be slightly modified by local topographic conditions, such as aspect. Large fluctuations in daily temperatures are common. Mean annual high temperatures range from 63-71 degrees Fahrenheit and mean annual low temperatures range from 32-40 degrees Fahrenheit. Approximately 70-75% occurs as rain from March through October. On the average, April, May, and June are the driest months and August through October are the wettest months. Precipitation is extremely variable from month to month and from year to year but averages between 7-12 inches a year. Much of the summer precipitation occurs as convection thunderstorms. This is a run-in site that receives additional moisture from surrounding sites. Rare to occasional flooding occurs from April to September.

Table 3. Representative climatic features

Frost-free period (average)	164 days
Freeze-free period (average)	190 days
Precipitation total (average)	12 in

Influencing water features

This site is not typically influenced by streams or wetlands.

Soil features

SOIL FEATURES
The soils are very deep and moderately well to well drained. Typically the dry surface is dark grayish brown to yellowish red. Typically soil surface fragments range from 0-8%. The soil temperature is regime mesic. The soil moisture regime is typically aridic (torric), but can be aridic ustic. Surface and subsurface textures are generally silty loams, clays, fine sandy loams, loamy fine sands, and very fine sandy loams. When this site is dominated by greasewood, soil salinities are high. When site is dominated by grasses, soil salinities are lower.

This site has been used in the following soil surveys and has been correlated to the following components:

UT631 – Henry Mountains Area – Havardad, Billings, Neskahi Family;

UT633 – Canyonlands Area – Redbank, Ustic Torrifluvents, Leeko, Thoughrofare;
UT638 – San Juan County, Central – Recapture;
UT643 – San Juan County, Navajo Indian Reservation – Aneth, Gotho, Tezuma;
UT685 - Begay, Calladito family, Elias family;
UT686 – Escalante Grand Staircase National Monument – Befar, Elias;
UT687 – Arches National Park – Patterfield;
UT688 – Canyonlands National Park – Mido;

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Clay (3) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately rapid
Soil depth	60 in
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	2.7–6.1 in
Calcium carbonate equivalent (0-40in)	0–25%
Electrical conductivity (0-40in)	0–32 mmhos/cm
Sodium adsorption ratio (0-40in)	0–20
Soil reaction (1:1 water) (0-40in)	7.9–11
Subsurface fragment volume <=3" (Depth not specified)	0–19%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

R035XY009UT Alkali Flat (Greasewood)
Plant Communities
Ecological Dynamics of the Site

This site is influence by many of the natural disturbances typical of MLRA 35. Fire is among such disturbances. Following a burn, greasewood immediately re-sprouts but grasses dominate the community. After a few years of average precipitation, greasewood regains dominance of the site. Due to modern disturbances such as brush treatments, invasive species, and OHV use, the resilience of the plant communities may be at risk. Disturbances that reduce the presence of the perennial plant community result in an opportunity for invasive annuals to enter into the system and shorten the fire interval. When this occurs this site may become dominated by annual invasives.

Following burn events, this site was likely historically grazed. Continuous season long grazing and or heavy stocking rates may cause this site to depart from the reference plant community. Improper grazing of perennial grasses may result in the loss of desirable grass species. This type of grazing may increase the chance of invasion by cheatgrass and invasive annual forbs.

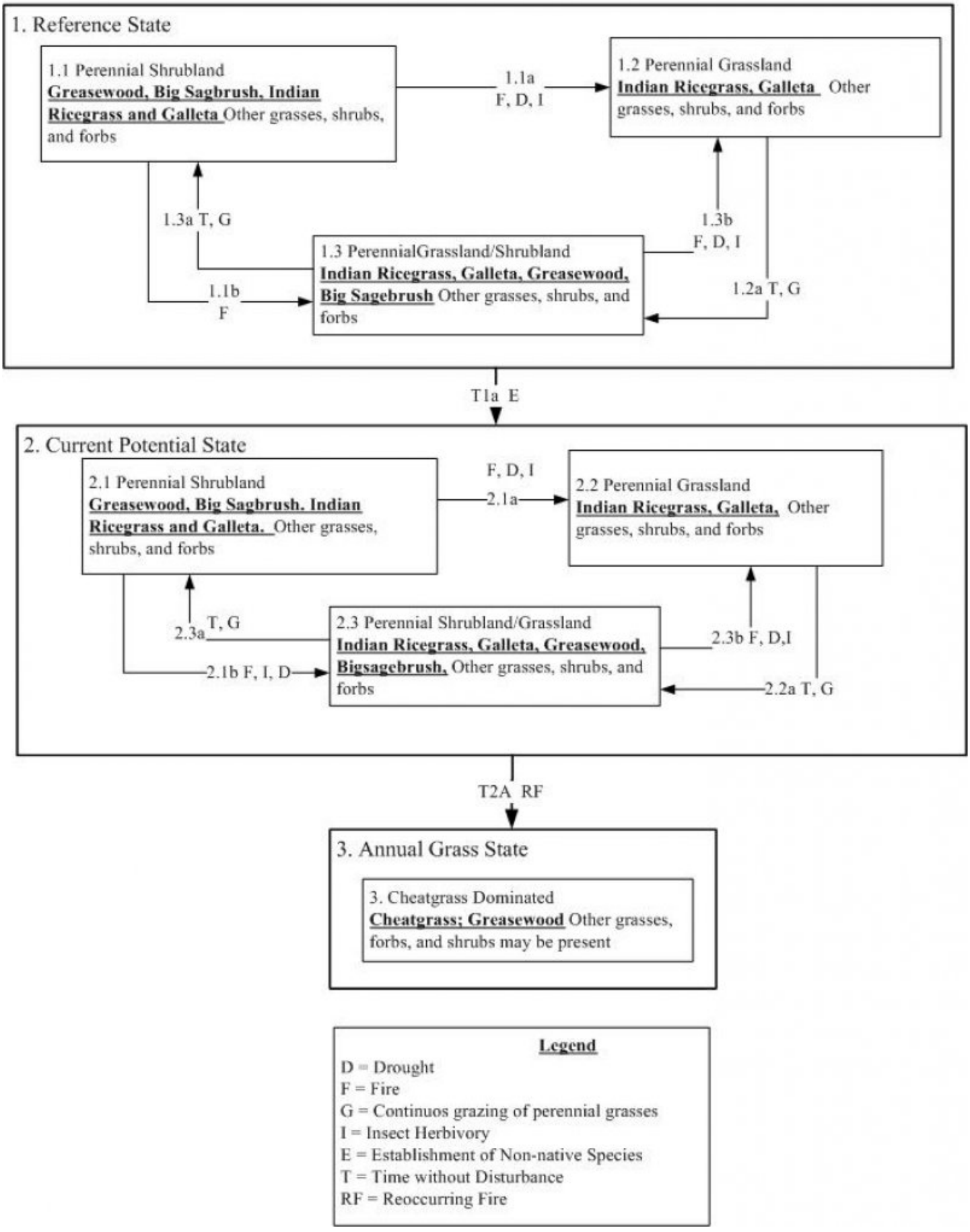
Soil salinity characteristics of this site are dynamic. Greasewood leaves concentrate salts which over time are deposited into the soil. Thus, soil salinities are expected to be influenced by the dominant plants of this site. When

greasewood dominates this site, soil salinities are high, and when grass dominates this site, soil salinities are lower.

As vegetation communities respond to changes in management or natural influences, return to previous states may not be possible. The amount of energy needed to affect vegetative shifts depends on present biotic and abiotic features and the desired results. The following diagram does not necessarily depict all the transitions and states that are possible, but it does show some of the most commonly occurring plant communities. These plant communities may not represent every possibility, but they are the most prevalent and repeatable. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. This model was developed using range data collected over the last 30 years in MLRA D35 in southeastern Utah. Both ocular and measured data was collected and utilized.

State and transition model

R035XY009UT Alkali Flat (Greasewood)



State 1
Reference State

The reference state represents the plant communities and ecological dynamics of the alkali flat (greasewood) site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under the natural disturbance regime. The reference state is generally dominated by greasewood. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When natural disturbances occur, the rate of recovery is variable due to disturbance intensity. Once invasive plants establish, return to the reference state may not be possible. Reference State: Greasewood state with fluctuations form a greasewood shrubland to a grassland and a grassland/shrubland community. Indicators: A community dominated by greasewood or perennial grasses. Feedbacks: Continuous season long grazing of perennial grasses, frequent fire, or other disturbance that may allow for the establishment of invasive species. At-risk Community Phase: This state is at risk when native plants are stressed and nutrients become available for invasive plants to establish. Trigger: The establishment of invasive plant species.

Community 1.1
Perennial Shrubland

This community is characterized by a greasewood shrub canopy, where some perennial grasses are present but contribute no more than 10 percent of total annual production. Commonly seen grasses include Indian ricegrass and galleta. As grass cover increases, shrub interspaces are filled. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground is variable (15-25%) depending on the amount of biological crusts (10 to 55).

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	250	380	520
Forb	20	45	70
Grass/Grasslike	30	50	65
Total	**300**	**475**	**655**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	0-10%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	3-5%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	15-25%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-10%	0-5%
>0.5 <= 1	–	5-15%	0-5%	0-10%
>1 <= 2	–	5-10%	0-5%	0-10%
>2 <= 4.5	–	0-10%	–	–
>4.5 <= 13	–	0-10%	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Perennial Grassland

This community is characterized by a perennial grassland, where some minimal amounts of shrubs are present. Commonly seen grasses include Indian ricegrass and galleta. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground is variable (10-25%) depending on the amount of biological crusts (10 to 55).

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	420	620	810
Shrub/Vine	50	100	150
Forb	20	45	70
Total	**490**	**765**	**1030**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	3-5%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-25%

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	10-20%	0-5%
>0.5 <= 1	–	0-10%	5-20%	0-10%
>1 <= 2	–	0-5%	0-10%	0-10%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.3
Perennial Grassland / Shrubland

This community is characterized by a perennial grassland and shrubland. In this phase, greasewood is co-dominant with perennial grasses. Commonly seen grasses include Indian ricegrass and galleta. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground is variable (10-30%) depending on the amount of biological crusts (10 to 55).

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	275	400	560
Shrub/Vine	90	130	200
Forb	20	45	70
Total	**385**	**575**	**830**

Table 12. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	3-5%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-30%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	10-20%	0-5%
>0.5 <= 1	–	0-10%	5-20%	0-10%
>1 <= 2	–	0-5%	0-10%	0-10%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	0-10%	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1a
Community 1.1 to 1.2

Fire, insect hervibory, and drought can reduce the greasewood dominance of this site and result in a grass dominated community.

Pathway 1.1b
Community 1.1 to 1.3

Less severe fire, insect herbivory, and drought can reduce the dominance of greasewood. This transition has occurred when greasewood production is reduced, but greasewood remains a dominant species.

Pathway 1.2a
Community 1.2 to 1.3

Time without disturbance and continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in greasewood.

Pathway 1.3a
Community 1.3 to 1.1

Time without disturbance and continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in greasewood.

Pathway 1.3b
Community 1.3 to 1.2

Fire that reduces only some of the greasewood.

State 2
Current Potential State

Community 2.1
Perennial Shrubland

This community is characterized by a greasewood shrub canopy, where some perennial grasses are present but contribute no more than 10 percent of total annual production. Commonly seen grasses include Indian ricegrass and galleta. As grass cover increases, shrub interspaces are filled. Other perennial grasses, shrubs, and forbs may or may not be present. Invasive species are present. Bare ground is variable (15-25%) depending on the amount of biological crusts (10 to 55).

Table 14. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	250	380	520
Forb	20	45	70
Grass/Grasslike	30	50	65
Total	**300**	**475**	**655**

Table 15. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	0-10%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	3-5%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	15-25%

Table 16. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-10%	0-5%
>0.5 <= 1	–	5-15%	0-5%	0-10%
>1 <= 2	–	5-10%	0-5%	0-10%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	0-10%	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
Perennial Grassland

This community phase is characterized by a perennial grassland where some minimal amounts of shrubs are present. Commonly seen grasses include Indian ricegrass and galleta. Other perennial grasses, shrubs, and forbs may or may not be present. Invasive species are present. Bare ground is variable (10-20%) depending on the amount of biological crusts (10 to 55).

Table 17. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	420	620	810
Shrub/Vine	50	100	150
Forb	0	45	70
Total	**470**	**765**	**1030**

Table 18. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	3-5%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-25%

Table 19. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	10-20%	0-5%
>0.5 <= 1	–	0-10%	5-20%	0-10%
>1 <= 2	–	0-5%	0-10%	0-10%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.3
Perennial Grassland / Shrubland

This community is characterized by a perennial grassland and shrubland. In this phase, greasewood is co-dominant with perennial grasses. Commonly seen grasses include Indian ricegrass and galleta. Other perennial grasses, shrubs, and forbs may or may not be present. Invasive species are present. Bare ground is variable (10-30%) depending on the amount of biological crusts (10 to 55).

Table 20. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	275	400	560
Shrub/Vine	90	130	200
Forb	0	45	70
Total	**365**	**575**	**830**

Table 21. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	3-5%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-30%

Table 22. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	10-20%	0-5%
>0.5 <= 1	–	0-10%	5-20%	0-10%
>1 <= 2	–	0-5%	0-10%	0-10%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	0-10%	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 2.1a
Community 2.1 to 2.2

Fire, insect hervibory, and drought can reduce the greasewood dominance of this site and result in a grass dominated community.

Pathway 2.1b
Community 2.1 to 2.3

Less severe fire, insect herbivory, and drought can reduce the dominance of greasewood. This transition has occurred when greasewood production is reduced, but greasewood remains a dominant species.

Pathway 2.2a
Community 2.2 to 2.3

Time without disturbance and continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in greasaewood.

Pathway 2.3a
Community 2.3 to 2.1

Time without disturbance and continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in greasewood.

Pathway 2.3b
Community 2.3 to 2.2

Fire that reduces only some of the greasewood.

State 3
Annual Grassland State

This community is characterized by the establishment and persistence of invasive annual grasses and forbs. The species of forbs and annual grasses present are a result of the area and seed sources. Due to the low number of sites currently in this state, the ability for this state to convert back to a shrubland is not well understood.

Community 3.1
Cheatgrass Dominated

This community phase is characterized by the establishment and persistence of invasive annual grasses and forbs. The species of forbs and annual grasses present are a result of the area and seed sources.

Table 23. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	275	400	560
Shrub/Vine	90	130	200
Forb	0	45	70
Total	**365**	**575**	**830**

Table 24. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	40-60%
Forb foliar cover	1-30%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	3-5%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-30%

Table 25. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	30-50%	0-5%
>0.5 <= 1	–	0-10%	5-20%	0-10%
>1 <= 2	–	0-5%	5-10%	0-10%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Transition T2A
State 2 to 3

This transition is from the current potential state into a state dominated by annual invasive plants. This transition occurs as events favor the increased establishment and dominance of annual invasive plants. Typically this occurs as a series of fires which lead to an increase in cheatgrass and a subsequent decrease in the fire return interval. Once invasive plant species drive the ecological dynamics of the site a threshold has been crossed.

Additional community tables

Table 26. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			180–420	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	170–420	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	10–30	–
3	**Sub-Dominant Shrubs**			50–100	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	35–120	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–36	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–20	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	Mojave seablite	SUMO	*Suaeda moquinii*	0–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
Grass/Grasslike					
0	**Dominant Grasses**			10–50	
	James' galleta	PLJA	*Pleuraphis jamesii*	0–50	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–42	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–15	–

	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–12	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–11	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
1	**Sub-Dominate Grass**			0–15	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–15	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–8	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–8	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–7	–
	saltgrass	DISP	*Distichlis spicata*	0–6	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	–
Forb					
2	**Forbs**			20–70	
	madwort	ALYSS	*Alyssum*	0–18	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	Arizona madrone	ARAR2	*Arbutus arizonica*	0–12	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–11	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–10	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	0–10	–
	gilia	GILIA	*Gilia*	0–6	–
	tansymustard	DESCU	*Descurainia*	3–6	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–6	–
	cryptantha	CRYPT	*Cryptantha*	0–6	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–6	–
	evening primrose	OENOT	*Oenothera*	0–6	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–5	–
	dock	RUMEX	*Rumex*	0–2	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–2	–
	blazingstar	MENTZ	*Mentzelia*	0–2	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	stickseed	LAPPU	*Lappula*	0–1	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–1	–

Table 27. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grass**			400–700	
	spike dropseed	SPCO4	*Sporobolus contractus*	90–250	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	80–200	–
	James' galleta	PLJA	*Pleuraphis jamesii*	30–150	–

	alkali sacaton	SPAI	*Sporobolus airoides*	30–100	–
	squirreltail	ELEL5	*Elymus elymoides*	20–60	–
1	**Sub-Dominant Grass**			20–110	
	Grass, perennial	2GP	*Grass, perennial*	0–40	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–30	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–20	–
	saltgrass	DISP	*Distichlis spicata*	0–20	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–15	–
Forb					
2	**Forbs**			20–70	
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–18	–
	madwort	ALYSS	*Alyssum*	0–18	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–11	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–10	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	0–10	–
	gilia	GILIA	*Gilia*	0–6	–
	tansymustard	DESCU	*Descurainia*	3–6	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–6	–
	cryptantha	CRYPT	*Cryptantha*	0–6	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–6	–
	evening primrose	OENOT	*Oenothera*	0–6	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	blazingstar	MENTZ	*Mentzelia*	0–2	–
	dock	RUMEX	*Rumex*	0–2	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–2	–
	Forb, annual	2FA	*Forb, annual*	0–2	–
	Forb, perennial	2FP	*Forb, perennial*	0–2	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–1	–
	stickseed	LAPPU	*Lappula*	0–1	–
Shrub/Vine					
3	**Shrubs**			15–100	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	5–100	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	10–100	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–36	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–25	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–20	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–15	–
	green molly	BAAM4	*Bassia americana*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–12	

	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–12	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–

Table 28. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			40–150	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	30–150	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	10–50	–
3	**Sub-Dominant Shrubs**			30–40	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	5–100	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–36	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–20	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–15	–
	green molly	BAAM4	*Bassia americana*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–12	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
Grass/Grasslike					
0	**Dominant Shrubs**			250–500	
	spike dropseed	SPCO4	*Sporobolus contractus*	150–200	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	100–150	–
	James' galleta	PLJA	*Pleuraphis jamesii*	40–75	–
	alkali sacaton	SPAI	*Sporobolus airoides*	30–60	–
1	**Sub-Dominant Grass**			15–60	
	Grass, perennial	2GP	*Grass, perennial*	0–40	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–30	–
	saltgrass	DISP	*Distichlis spicata*	0–20	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–20	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–10	–
Forb					
2	**Forbs**			20–70	
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–18	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–11	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–

	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–10	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	0–10	–
	gilia	GILIA	*Gilia*	0–6	–
	tansymustard	DESCU	*Descurainia*	3–6	–
	madwort	ALYSS	*Alyssum*	0–6	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–6	–
	cryptantha	CRYPT	*Cryptantha*	0–6	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–6	–
	evening primrose	OENOT	*Oenothera*	0–6	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	blazingstar	MENTZ	*Mentzelia*	0–2	–
	dock	RUMEX	*Rumex*	0–2	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–2	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–1	–
	stickseed	LAPPU	*Lappula*	0–1	–

Table 29. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			180–420	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	170–420	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	6–300	–
3	**Sub-Dominant Shrubs**			20–100	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	5–100	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–36	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–20	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	green molly	BAAM4	*Bassia americana*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–12	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
Grass/Grasslike					
0	**Dominant Grass**			10–50	
	James' galleta	PLJA	*Pleuraphis jamesii*	0–50	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–42	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–12	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–11	–
	cheatgrass	BRTE	*Bromus tectorum*	1–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
1	**Sub-Dominant Grass**			0–15	

	western wheatgrass	PASM	*Pascopyrum smithii*	0–15	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–8	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–8	–
	saltgrass	DISP	*Distichlis spicata*	0–6	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	–
Forb					
2	**Forbs**			20–80	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–80	–
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–52	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–18	–
	fivehorn smotherweed	BAHY	*Bassia hyssopifolia*	0–15	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	0–15	–
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–11	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	madwort	ALYSS	*Alyssum*	0–6	–
	tansymustard	DESCU	*Descurainia*	3–6	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–6	–
	gilia	GILIA	*Gilia*	0–6	–
	cryptantha	CRYPT	*Cryptantha*	0–6	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–6	–
	evening primrose	OENOT	*Oenothera*	0–6	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	dock	RUMEX	*Rumex*	0–2	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–2	–
	blazingstar	MENTZ	*Mentzelia*	0–2	–
	stickseed	LAPPU	*Lappula*	0–1	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–1	–

Table 30. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grass**			400–700	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	80–200	–
	James' galleta	PLJA	*Pleuraphis jamesii*	30–150	–
	spike dropseed	SPCO4	*Sporobolus contractus*	90–150	–
	alkali sacaton	SPAI	*Sporobolus airoides*	30–100	–
	cheatgrass	BRTE	*Bromus tectorum*	1–50	–
	squirreltail	ELEL5	*Elymus elymoides*	20–30	–

1	**Sub-Dominant Grass**			20–110	
	Grass, annual	2GA	*Grass, annual*	0–40	–
	Grass, perennial	2GP	*Grass, perennial*	0–40	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–30	–
	saltgrass	DISP	*Distichlis spicata*	0–20	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–20	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
Forb					
2	**Fobs**			20–70	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–60	–
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–52	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–18	–
	fivehorn smotherweed	BAHY	*Bassia hyssopifolia*	0–15	–
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–11	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	0–10	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–10	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–6	–
	gilia	GILIA	*Gilia*	0–6	–
	cryptantha	CRYPT	*Cryptantha*	0–6	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–6	–
	madwort	ALYSS	*Alyssum*	0–6	–
	tansymustard	DESCU	*Descurainia*	3–6	–
	evening primrose	OENOT	*Oenothera*	0–6	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	dock	RUMEX	*Rumex*	0–2	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–2	–
	blazingstar	MENTZ	*Mentzelia*	0–2	–
	stickseed	LAPPU	*Lappula*	0–1	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–1	–
Shrub/Vine					
3	**Sub-Dominant Shrubs**			15–150	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	5–100	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	10–100	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–36	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–25	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–20	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–15	–
	green molly	BAAM4	*Bassia americana*	0–15	–

	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–12	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–

Table 31. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			40–150	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	30–150	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	10–50	–
3	**Sub-Dominant Shrubs**			30–40	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	5–100	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–36	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–20	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–15	–
	green molly	BAAM4	*Bassia americana*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–12	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
Grass/Grasslike					
0	**Dominant Grass**			250–300	
	spike dropseed	SPCO4	*Sporobolus contractus*	70–150	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	60–100	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–75	–
	alkali sacaton	SPAI	*Sporobolus airoides*	20–60	–
	squirreltail	ELEL5	*Elymus elymoides*	0–30	–
	cheatgrass	BRTE	*Bromus tectorum*	1–15	–
1	**Sub-Dominant**			15–60	
	Grass, annual	2GA	*Grass, annual*	0–40	–
	Grass, perennial	2GP	*Grass, perennial*	0–40	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–30	–
	saltgrass	DISP	*Distichlis spicata*	0–20	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–20	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
Forb					
2	**Forbs**			30–70	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–70	–
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–52	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–18	–

	snowball sand verbena	ABPA2	*Abronia fragrans*	0–10	
	fivehorn smotherweed	BAHY	*Bassia hyssopifolia*	0–15	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	evening primrose	OENOT	*Oenothera*	0–11	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–11	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–10	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	0–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	madwort	ALYSS	*Alyssum*	0–6	–
	tansymustard	DESCU	*Descurainia*	3–6	–
	gilia	GILIA	*Gilia*	0–6	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–6	–
	cryptantha	CRYPT	*Cryptantha*	0–6	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–6	–
	dock	RUMEX	*Rumex*	0–2	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–2	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	blazingstar	MENTZ	*Mentzelia*	0–2	–
	stickseed	LAPPU	*Lappula*	0–1	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–1	–

Table 32. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			40–150	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	40–150	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	10–50	–
3	**Sub-Dominant Shrubs**			30–40	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	5–100	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–36	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–20	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–15	–
	green molly	BAAM4	*Bassia americana*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–12	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
Grass/Grasslike					
0	**Dominant Grass**			250–500	

0	**Dominant Grass**			250–300	
	spike dropseed	SPCO4	*Sporobolus contractus*	70–150	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	60–100	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–75	–
	alkali sacaton	SPAI	*Sporobolus airoides*	20–60	–
	squirreltail	ELEL5	*Elymus elymoides*	5–20	–
	cheatgrass	BRTE	*Bromus tectorum*	1–15	–
1	**Sub-Dominant Grass**			15–60	
	Grass, annual	2GA	*Grass, annual*	0–40	–
	Grass, perennial	2GP	*Grass, perennial*	0–40	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–30	–
	saltgrass	DISP	*Distichlis spicata*	0–20	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–20	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–15	–
Forb					
2	**Forbs**			20–70	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–70	–
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–52	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–18	–
	fivehorn smotherweed	BAHY	*Bassia hyssopifolia*	0–15	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–11	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–10	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	0–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	madwort	ALYSS	*Alyssum*	0–6	–
	tansymustard	DESCU	*Descurainia*	3–6	–
	gilia	GILIA	*Gilia*	0–6	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–6	–
	cryptantha	CRYPT	*Cryptantha*	0–6	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–6	–
	evening primrose	OENOT	*Oenothera*	0–6	–
	dock	RUMEX	*Rumex*	0–2	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	blazingstar	MENTZ	*Mentzelia*	0–2	–
	stickseed	LAPPU	*Lappula*	0–1	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–1	–

Animal community

--General wildlife--
This site provides both food and cover for wildlife. There is palatable browse for mule deer and pronghorn, and

when present, grasses such as Indian rice grass and galleta offer good grazing. When this site occurs near water, the species richness and the abundance of large mammals is increased. Birds, Bats, lizards, snakes and rodents are more common when this site occurs far from water. Birds from several families are common, from hawks to sparrows.
Several species of rodents forage and occupy this site including desert cottontail, black tailed jack rabbit, white–tailed Antelope squirrel, Apache pocket mouse, several species of Peromyscus. Coyotes and kit foxes will also forage in the area. Bats (Myotis, Pipisturellus, and others) can be observed in this ecological site, but are likely limited to areas with more roosting opportunities or near water or canyons. The Collared lizard and the common side blotched lizards are most commonly seen, though several other lizards us the site.

--Grazing Interpretations--
This site provides fair to good grazing conditions for livestock in the reference state. This site also has relatively high importance for winter grazing due to greasewood being rich in carotene (vitamine A) and the preferable climate (USU.edu, 2009). For goats, the grazing value is increased (fair to good). Care should be taken to maintain the native perennial grasses and shrubs due to the poor suitability for re-seeding or restoring this site. Reseeding and/or restoration are difficult due to the extreme temperatures and variability in time and amount of precipitation. Once the native perennial grasses have been removed, they may never be restored due to the competitiveness of greaswood.

The plant community is primarily shrubs, with the majority of canopy cover being attributed to greasewood; sub dominants include big sagebrush, fourwing saltbush, and shadscale saltbush. These shrubs provide fair winter browse for cattle and sheep, as well as fair year round browse for goats. When present, grasses, primarily Indian ricegrass and galleta provide good year round grazing forage for horses, cattle, and sheep; however many times these species are not abundant enough to support livestock. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation must be made.

Hydrological functions

The majority of the soils are in hydrologic group B. Befar is in hydrologic group D and Billings is in C (NRCS National Engineering Handbook). Hydrologic groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but it is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff. (National Range and Pasture Handbook, 2003)

Recreational uses

Recreation activities include aesthetic value and good opportunities for hiking, horseback riding, and off-road vehicle use.

Wood products

None

Other products

The wood from greasewood can be used for campfire fuel (USU.edu, 2009).

Other information

--Poisonous and Toxic Plant Communities--
Greaswood can be harmful to cattle and sheep when consumed in too large of dose. The leaves of greasewood contain poisonous oxilates that when consumed by sheep can result in sheep mortality. The toxicity of greasewood

is increased during the growing season (USU.edu, 2009). In addition to the poisonous nature of greasewood, the spines of greasewood have been known to puncture the rumen of cattle (USU.edu, 2009).

Other toxic plants associated with this site include woolly locoweed and broom snakeweed. Woolly locoweed is toxic to all classes of livestock and wildlife. Locoweed is palatable and had similar nutrient value to alfalfa, which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (indolizdine alkaloid) and is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing and is associated with 4 major symptoms 1) neurological damage, 2) emaciation, 3) reproductive failure and abortion, and 4) congestive heart failure linked with “high mountain disease”. Broom snakeweed contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep generally will only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest. (Knight and Walter, 2001)

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors, such as after a rain storm during a drought, cool/cloudy days, and soils high in nitrogen and low in sulfur and phosphorus, all which cause increased nitrate accumulation. Nitrate collects in the stems and can persist throughout the growing season. Clinical signs of nitrate poisoning include drowsiness, weakness, muscular tremors, increased heart and respiratory rates, staggering gait, and death. Conversely, oxalate poisoning causes kidney failure; clinical signs include muscle tremors, tetany, weakness, and depression. Poisoning generally occurs when livestock consume and are not accustomed to grazing oxalate-containing plants. Animals with prior exposure to oxalates have increased numbers of oxalate-degrading rumen microflora and thus are able to degrade the toxin before clinical poisoning can occur. (Knight and Walter, 2001)

--Invasive Plant Communities--
Generally as ecological conditions deteriorate and native vegetation decreases due to disturbance (fire, improper livestock grazing, drought, off road vehicle overuse, erosion, etc.) invasive species can establish on the site. Of particular concern in semi-arid environments are the non-native annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

--Fire Ecology--
Following a burn, greasewood immediately re-sprouts but grasses dominate the community. After a few years of average precipitation, greasewood regains dominance of the site. When fuel loads are low, this site burns more slowly and less intense. Such burns result in a perennial grassland and shrubland with grasses and greasewood being co-dominant.

Inventory data references

The data collected in 2005-2008 were in conjunction with the soil survey update for Arches and Canyonlands National Park. The vegetation data was collected in associated with a soil pit and geo-referenced. All the data is stored as hard copy files and in electronic format in the NRCS Utah State Office.

Type locality

Location 1: San Juan County, UT	
UTM zone	N
UTM northing	4289778
UTM easting	628305
General legal description	Canyonlands National Park

Other references

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NRCS Grazing Lands Technology Institute. 2003. National Range and Pasture Handbook. Fort Worth, TX, USA: US Department of Agriculture, Natural Resources Conservation Service, 190-VI-NRPH.

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Contributors

Ashley Garrelts, Jake Owens

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Shane A. Green (NRCS), Robert D. Stager (BLM), Dana Truman (NRCS), Paul Curtis (BLM) and Randy Beckstrand (BLM).
Contact for lead author	shane.green@ut.usda.gov
Date	09/10/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very minor rill development in exposed areas. If rills are present, they should be widely spaced, and rarely connected. As slopes increase, or on sites adjacent to watersheds or runoff producing areas (i.e. slickrock, steep sites, etc.) rill number and length may increase. Rill development will increase following large storm events, but rills heal within a few years through frost heaving.

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2. **Presence of water flow patterns:** Flow patterns are usually sinuous and wind around perennial plant bases and areas of developed/pinnacled biological crusts. They are expected to be somewhat short (10 to 20 feet), narrow (< 6 inches

wide), and widely spaced (20 feet or more). Water flow paterns are stable with only minor evidence of deposition. Evidence of flow patterns will increase somewhat with a slope greater than 3 percent. Deposition in water flow patterns may increase if the site is adjacent to watersheds or runoff producing areas (i.e. slickrock, steep sites, etc.)

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3. **Number and height of erosional pedestals or terracettes:** Plants may show minor pedestalling where they are adjacent to water flow patterns, exposed root should not be apparent. Slight coppice mounding under shrubs is common, and should not be confused with pedestalling. Terracettes should be very few and stable where they have accumulated behind woody debris obstructions in water flow patterns.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 15-25%. Ground cover is based on the first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%. Poorly developed biological soil crust that is interpreted as functioning as bare ground and therefore would be susceptible to raindrop splash erosion should be recorded as bare ground.

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5. **Number of gullies and erosion associated with gullies:** Present, but rare. They would usually be expected in locations where there are concentrated flows into the site from an adjacent sites or watersheds. Gullies should show some signs of active erosion often with steep side walls and salts forming on the surface but the bottoms would be mostly stabilized with perennial vegetation. Gullies may show more indication of erosion as the slope gets greater than 3 percent, or as influenced by adjacent steep sites or watersheds that may be providing concentrated flow patterns, or following large storm events.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of wind generated soil movement Wind scoured (blowouts) and depositional areas are rarely present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Often litter from adjacent sites or watersheds contribute to litter noted on this ecological site. Fine litter removal may occur in flow patterns with deposition occurring at points of obstruction, especially following large storm events. Fine litter movement is expected to increase with slopes over 3 percent. Most litter is often found beneath plant canopies.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 3 or 4 under plant canopies and a rating of 2 to 3 in the interspaces using the soil stability kit test. The average should be a 3. Surface texture varies from loamy sand to silty clay loam. Vegetation cover, litter, and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is typically 1-5 inches deep. Structure is typically weak fine to medium granular. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants are expected to break raindrop impact and splash erosion. Spatial distribution of vascular plants slows runoff somewhat by obstructing surface flows to help create sinuous flow

patterns that dissipate energy and allow time for some infiltration. The amount of Na in the soil is the overriding factor influencing infiltration. Natural erosion would be expected in severe thunder storms or heavy spring runoff. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration will be reduced.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Due to this sites lower placement (bottoms etc.), it accumulates fine particles such as silts and clays. The associated blocky and massive structures formed from these soil textures often confer naturally occurring hard layers in the soil subsurface. These should not be considered to be compaction layers.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Sprouting shrubs with deep tap roots (Greasewood)

    Sub-dominant: Perennial grasses (Alkali Sacaton, bottlebrush squirreltail, Galleta) = non-sprouting shrubs (Shadscale, fourwing saltbush) > perennial forbs (globemallow)

    Other: Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.
    Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Crested wheatgrass, Intermediate wheatgrass, etc.)
    Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover.

    Additional: Temporal variability is caused by fires, droughts, insects, etc. and spatial variability is caused by adjacency to other sites that produce runoff, soil pH levels, and topography.
    Following a recent disturbance such as fire, drought, or insects that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. If a disturbance has not occurred for an extended period of time, woody species may continue to increase crowding out the perennial herbaceous understory species. In either case, these conditions reflect a community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. During severe (multi-year) drought that affects groundwater levels, up to 20% of the greasewood plants may die. Some mortality of bunchgrass and other shrubs may also occur during severe droughts. There may be partial mortality of individual bunchgrasses and other shrubs during less severe drought.

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14. **Average percent litter cover (%) and depth (in):** Litter cover (including under plants)nearly all of which should be fine litter. Depth should be 1 leaf thickness in the interspaces and up to ¼" under canopies. Litter cover may increase to 7-20% on some years due to increased production of annual plants.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 700 - 800 #/acre on an average year

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Russian thistle, halogeton, mustard, filarie, other native and non-native annual forbs and cheatgrass

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in most years, except in drought years

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